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(54) [Title of the Invention] IMAGE PROCESSING APPARATUS

(57) [Abstract]

[Object] To provide an image processing apparatus capable of performing flexible two-color separation.

[Solving Means] Color image data is separated into three colors, that is, red, green, and blue, and is converted into a two-color image based on each brightness level. For example, when the image data is converted into a two-color pixel whose colors are designated as red and black, a red first correction value, a red second correction value, and a green threshold value are set, and evaluation of expression (1): green brightness level > green threshold value; expression (2): red brightness level > (green brightness level + red first correction value); and expression (3): red brightness level > (green brightness level + red second correction value) are performed for each pixel forming the image data. As a result of the computations, discrimination of two-color separation is performed in which pixels are identified to be red where

expressions (1) and (2) are satisfied, or expression (1) is not satisfied but expression (3) is satisfied, and in which pixels other than those are identified to be non-red. The red first correction value, the red second correction value, and the green threshold value are set with reference to the blue brightness level.

[Claims]

[Claim 1] An image processing apparatus comprising color detecting means for separating color image data into three colors, red, green, and blue, and converting the image data into a two-color image with designated colors of red and black based on each brightness level,

wherein, when converting into the two-color pixels, the color detecting means sets a red first correction value, a red second correction value, and a green threshold value, and evaluates the following expression (1), expression (2), and expression (3) for each pixel forming the image data:

green brightness level > green threshold value (1)

red brightness level > (green brightness level + red first correction value) (2)

red brightness level > (green brightness level + red second correction value) (3);

wherein, discrimination of two-color separation is performed in which red is discriminated for pixels in which expression (1) and expression (2) are satisfied, or expression (1) is not satisfied but expression (3) is satisfied, and non-red is discriminated for pixels other than those; and

wherein, the red first correction value, the red second correction value, and the green threshold value are set with reference to the blue brightness level.

[Claim 2] The image processing apparatus according to Claim 1, wherein a plurality of the red first correction values, the red second correction

values, and the green threshold values is set in advance, from which values are selected based on the blue brightness level, and the discrimination is performed.

[Claim 3] An image processing apparatus comprising color detecting means for separating color image data into three colors, red, green, and blue, and converting the image data into a two-color image with designated colors of blue and black based on each brightness level,

wherein, when converting into the two-color pixels, the color detecting means sets a blue first correction value, a blue second correction value, and a red threshold value, and evaluates the following expression (4), expression (5), and expression (6) for each pixel forming the image data:

red brightness level > green threshold value (4)

blue brightness level > (green brightness level + red first correction value) (5)

blue brightness level > (green brightness level + red second correction value) (6);

wherein, discrimination of two-color separation is performed in which blue is discriminated for pixels in which expression (4) and expression (5) are satisfied, or expression (4) is not satisfied but expression (6) is satisfied, and non-blue is discriminated for pixels other than those; and

wherein, the blue first correction value, the blue second correction value, and the red threshold value are set with reference to the green brightness level.

[Claim 4] The image processing apparatus according to Claim 3, wherein a plurality of the blue first correction values, the blue second correction values, and the red threshold values is set in advance, from which values are selected based on the green brightness level, and the discrimination is performed.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention] The present invention relates to an image processing apparatus in copying machines, facsimile machines, and printers having a digital image processing capability.

[0002]

[Description of the Related Art] Conventionally, a two-color red/black or blue/black copying machine is used as an image processing apparatus in copying machines, facsimile machines, and printers having a digital image processing capability. Such two-color copying is a method for separating a color image into three colors, that is, red, green, and blue, and converting it into a red/black image according to the red and green data, or a two-color blue/black image according to the blue and red data.

[0003] For example, an "image processing apparatus" is disclosed in Japanese Patent Application No. 6-89879 by the present inventor as a method for color separation. In this method, the range of discrimination of red, black, and white is set based on red and green data and a two-color red/black image is produced, or the range of discrimination of blue, black, and white is set based on blue and red data and a two-color

blue/black image is produced. A color-shift correction method corresponds to a color shift of one pixel.

[0004]

[Problems to be Solved by the Invention] However, in the aforementioned conventional color separation method, the range of color separation is fixed by setting correction values and a threshold value for color discrimination. More specifically, when a red/black image is separated, only red and green brightness levels are used for discriminating red, and when a blue/black image is separated, only blue and red brightness levels are used for discriminating blue. Accordingly, a problem is experienced in that flexible color separation cannot be obtained. Although the prior invention by the same applicant of the present invention has a feature such that it can also perform the correction of a color shift of 1 dot or more, for example, when the designated color is red, discrimination of the color separation is fixed by setting a green threshold value and red correction values.

[0005] The object of the present invention is, therefore, to provide an image processing apparatus capable of providing flexible two-color separation.

[0006]

[Means for Solving the Problems] In order to achieve the above object, an image processing apparatus according to Claim 1 includes color detecting means for separating color image data into three colors, red, green, and blue, and converting the image data into a two-color image with designated colors of red and black based on each brightness level,

wherein when converting into the two-color pixels, the color detecting means sets a red first correction value, a red second correction value, and a green threshold value, and evaluates the following expression (1), expression (2), and expression (3) for each pixel forming the image data:

green brightness level > green threshold value (1)

red brightness level > (green brightness level + red first correction value) (2)

red brightness level > (green brightness level + red second correction value) (3);

wherein, discrimination of two-color separation is performed in which red is discriminated for pixels in which expression (1) and expression (2) are satisfied, or expression (1) is not satisfied but expression (3) is satisfied, and non-red is discriminated for pixels other than those, and wherein the red first correction value, the red second correction value, and the green threshold value are set with reference to the blue brightness level.

[0007] Preferably, a plurality of the red first correction values, the red second correction values, and the green threshold values is set in advance, from which values are selected based on the blue brightness level, and the discrimination is performed.

[0008] An image processing apparatus according to Claim 3 includes color detecting means for separating color image data into three colors, red, green, and blue, and converting the image data into a two-color image with designated colors of blue and black based on each brightness level,

wherein, when converting into the two-color pixel, the color detecting means sets a blue first correction value, a blue second correction value, and a red threshold value, and evaluates the following expression (4), expression (5), and expression (6) for each pixel forming the image data:

red brightness level > green threshold value (4)

blue brightness level > (green brightness level + red first correction value) (5)

blue brightness level > (green brightness level + red second correction value) (6);

wherein, discrimination of two-color separation is performed in which blue is discriminated for pixels in which expression (4) and expression (5) are satisfied, or expression (4) is not satisfied but expression (6) is satisfied, and non-blue is discriminated for pixels other than those, and wherein the blue first correction value, the blue second correction value, and the red threshold value are set with reference to the green brightness level.

[0009] Preferably, a plurality of the blue first correction values, the blue second correction values, and the red threshold values is set in advance, from which values are selected based on the green brightness level, and the discrimination is performed.

[0010]

[Embodiment] An embodiment of the image processing apparatus according to the present invention will be specifically described with reference to the drawings. An embodiment of the image processing apparatus

according to the present invention is shown in Figs. 1 to 5.

[0011] <Color Separation Image Processing Method> An image processing apparatus according to this embodiment is formed of three processing sections: a color detecting section, a white/black determining section, and a color-shift correcting section. The connection of the three processing sections is shown in Fig. 1.

[0012] 1. Method for Detecting Color

In the method for detecting color, a color image is separated into three colors, that is, red, green, and blue. When the designated color is red (that is, a red/black mode), the color is determined based on red and green brightness levels for each pixel. When the designated color is blue (that is, a blue/black mode), the color is determined based on blue and red brightness levels for each pixel. The color determining range can be controlled by correction values or a threshold value. Examples of the areas of color separation of the red/black mode and the blue/black mode are shown in Figs. 2 and 3, respectively.

[0013] Subsequently, the procedure for detecting a potential red color from a color image in the red/black mode will be described. First, in order to determine the red detection range, two correction values (correction value 1 and correction value 2) for red, and a threshold value for green are set in advance. Red and green brightness level signals are extracted from the brightness level signals of three colors, that is, red, green, and blue, of the separated color image. These brightness level signals are evaluated based on the following expressions (1), (2), and (3), thereby performing determination based on

the obtained results. The determination method is shown in Fig. 9. Consequently, the result of determining whether the target pixel is red or not can be obtained.

[0014]

$G > K_G$ ...(1)

$R > G + K_{R1}$ ...(2)

$R > G + K_{R2}$ ...(3)

where each symbol denotes the following:

R: red brightness level signal

G: green brightness level signal

K_G: green threshold value

K_{R1}: red correction value 1

K_{R2}: red correction value 2

[0015] Subsequently, the procedure for detecting a potential blue color from a color image in the blue/black mode will be described. First, in order to determine the blue detection range, two correction values (correction value 1 and correction value 2) for blue, and a threshold value for red are set in advance. Blue and red brightness level signals are extracted from the brightness level signals of three colors, that is, red, green, and blue, of the separated color image. These brightness level signals are evaluated based on the following three expressions, thereby performing determination based on the obtained results. The determination method is shown in Fig. 10. Consequently, the result of determining whether the target pixel is blue or not can be obtained.

[0016]

$R > K_R$ ...(4)

$B > R + K_{B1}$ ...(5)

$B > R + K_{B2}$ ...(6)

where each symbol denotes the following:

R: red brightness level signal

B: blue brightness level signal

K_R: red threshold value

K_{B1}: blue correction value 1

K_{B2}: blue correction value 2

[0017] In the color sections where three colors R, G, and B are used as coordinates, the distribution characteristics of a potential red color and a potential blue color are shown in Figs. 4 and 5, respectively. In Fig. 4 in which B is used as a parameter, in a plane with R as the horizontal axis and G as the vertical axis, when the brightness level of B is 0, the distribution area of the potential red color is large. When the brightness level of B is 255, the distribution area of the potential red color is small. In other words, in the R-G plane, the distribution area of the potential red color is decreased as the brightness level of B increases. Also, the position of the distribution tends to shift to the upper part of the plane.

[0018] Similarly, in Fig. 5 in which G is used as a parameter, in a plane with B as the horizontal axis and R as the vertical axis, when the brightness level of G is 0, the distribution area of the potential blue color is large. When the brightness level of G is 255, the distribution area of the potential blue color is small. In other words, in the B-R

plane, the distribution area of the potential blue color is decreased as the brightness level of G increases. Also, the position of the distribution tends to shift to the upper part of the plane. For coping with the above problems, it is preferable to use variable values as the correction values and the threshold value used in the mathematical expressions for the color separation in order to separate a more appropriate color when performing the color separation.

[0019] When the designated colors are red and black, it is preferable to appropriately control the red first correction value, the red second correction value, and the green threshold value based on the blue brightness level in order to detect a color which is visually close to red. Also, when the designated colors are blue and black, it is preferable to appropriately control the blue first correction value, the blue second correction value, and the red threshold value based on the green brightness level in order to detect a color which is visually close to blue.

[0020] When the designated colors are red and black, the red first correction value, the red second correction value, and the green threshold value are each set with a plurality of levels (for example, three levels). The blue brightness level is also divided into the same number. At first, the blue brightness level is determined for the input pixel data, and the red first correction value, the red second correction value, and the green threshold value corresponding to the brightness level are selected, and then it is determined whether the pixel is red or not based on the above-described expressions for

determining red-separation.

[0021] When the designated colors are blue and black, the blue first correction value, the blue second correction value, and the red threshold value are each set with a plurality of levels (for example, three levels). The green brightness level is also divided into the same number. At first, the green brightness level is determined for the input pixel data, and the blue first correction value, the blue second correction value, and the red threshold value corresponding to the brightness level are selected, and then it is determined whether the pixel is blue or not based on the above-described expressions for determining blue-separation.

[0022] Fig. 11 shows the respective relationship between the blue brightness level, which is separated into three levels when red/black is separated, and the red first correction value, the red second correction value, and the green threshold value. Fig. 12 shows the respective relationship between the green brightness level, which is separated into three levels when blue/black is separated, and the blue first correction value, the blue second correction value, and the red threshold value.

[0023] 2. Method for Determining White or Black

In the above-described method for detecting the color, for a pixel that is determined to be in a red/black mode and non-red or in a blue/black mode and non-blue, it is determined whether it is white or black depending on the brightness of the pixel. The expressions for determination are shown in Fig. 13.

[0024] 3. Method for Correcting Color-Shift

The process for converting a color image into a two-color image of red/black or blue/black can be performed by the above-described method (1) for determining color and the method (2) for determining white or black. However, there is a possibility such that a color shift occurs in the converted two-color image due to unevenness of illumination in a scanning system or displacement of the position in a CCD line. Particularly, it is likely to occur at the edge of the image. For coping with the above problem, pixels in the vicinity of the target pixel whose color discrimination is finished are checked and the state of the color shift of the pixels is determined, and the correction is then performed.

[0025] In the method for correction, two pixels at each of the left and right of the target pixel as the central pixel in the same line and pixels in two lines before and two lines after in the main scanning direction, or a total of 25 pixels, construct a 5 x 5 pixel matrix, as shown in Fig. 6. From them, a total of eight linear patterns consisting of four elements shown in Fig. 7 are extracted vertically, horizontally, and diagonally with the target pixel as the third element.

[0026] Taking in consideration of the correction state, each of the eight extracted patterns is compared with the reference patterns, that is, seven correction patterns which are set in advance. If even one of the eight patterns matches one of the reference patterns, it is determined that a color shift occurs. The target pixel is corrected according to a correction rule corresponding to the reference pattern. Correction is not performed for a pixel in which no color shift occurs as a result of the comparison, and an output is produced as a result of

the determination of method 1 and method 2. The rules for the correction process are shown in Fig. 14. In Fig. 14, there are two sets of reference patterns, No. 1 to No. 5 and No. 1 to No. 7.

[0027] <Apparatus for Performing Image Processing Method> This image processing apparatus includes a register section 1, an input selecting section 2, a color detecting section 3, a color determining section 4, a matrix generating section 5, a pattern matching section 6, a color-shift correcting section 7, a brightness evaluating section 8, a timing control section 9, and a correction-value selecting section 10. The entire block diagram is shown in Fig. 8.

[0028] 1. Description of Blocks

(1) Register Section

This is a section for storing the characteristic data of a first correction value, a second correction value, and a threshold value for detecting color and determining the color. The characteristic data supplied from the outside by setting an image processing mode is written thereto. In the red/black mode, the red correction value 1, the red correction value 2, and the green threshold value for detecting red are externally set in advance, and in the blue/black mode, the blue correction value 1, the blue correction value 2, and the red threshold value for detecting blue are externally set in advance, and they are stored in the resister section. In addition, the data of a mode for showing color separation and a threshold value of the brightness for determining white or black are also set.

[0029] (2) Input Selecting Section

This is a section which selects an input data signal of the color detecting section. Two pieces of signal data are selected from 8-bit data of the three red, green, and blue brightness levels of the input color image based on the data of the mode which is set in the register section 1, and are output to the color detecting section 3. Red and green data are output in the red/black mode, and blue and red data are output in the blue/black mode.

[0030] (3) Color Detecting Section

This is a section that decides whether the pixel is color or non-color based on the two pieces of input color data. A color detecting process is performed for each pixel based on the data of the correction value 1, the correction value 2, and the threshold value of the designated color from the register section 1 and the image data input from the input selecting section 2 according to the above-described method for detecting color. The result of color detection is output to the color determining section 4.

[0031] (4) Color Determining Section

The threshold value of the brightness is read from the register section 1, and a process for determining whether the pixel is color, black, or white is performed for each pixel based on the data from the color detecting section 3 and the brightness evaluating section 8. The result of the color determination is output to the matrix generating section 5.

[0032] (5) Matrix Generating Section

By setting the result of the color determination by the color determining section 4 as input, five lines of pixels are stored, from

each line of which five pixels are extracted, and a 5 × 5 matrix is formed. From them, eight linear patterns composed of 4 elements are extracted vertically, horizontally, and diagonally with the target pixel as the third pixel. The eight patterns are output to the pattern matching section 6.

[0033] (6) Pattern Matching Section

The eight patterns output from the matrix generating section 5 are set as inputs, and are compared with each of the reference patterns defined in advance. The result of the comparison, that is, the data on whether they match or not, is output to the color-shift correcting section 7.

[0034] (7) Color-Shift Correcting Section

It is determined whether or not to perform color-shift correction based on the result of the pattern matching section 6. The correction process is performed on the target pixel in a pattern which matches the reference pattern according to the above-described method in Fig. 14. The pixel data after the correction process is externally output. For a pattern which does not match the reference patterns, the target pixel is not subjected to the correction process, and is output unchanged.

[0035] (8) Brightness Evaluating Section

By setting red, green, and blue 8-bit image data of the color image as input, the brightness level is evaluated for each pixel. The result of the evaluation is output to the color determining section 4 and the timing control section 9.

[0036] (9) Timing Control Section

Timing is controlled with respect to the input data from the brightness

evaluating section 8 in order to eliminate a delay relative to the output of the color-shift correcting section 7, and is externally output.

[0037] (10) Correction-Value Selecting Section

The color first correction value, the color second correction value, the color threshold value, and the mode data are input from the register section 1. Blue and green image data is also input. The data of the color first correction value, the color second correction value, and the color threshold value is selected based on the mode data and the blue or green data level. The color first correction value, the color second correction value, and the color threshold value are provided to the color detecting section 3.

[0038] 2. Description of Overall Operation

The two-color copying machine of the embodiment according to the present invention can operate in two modes of two colors, red/black and blue/black. Setting of the mode can be automatically performed depending on the kind of color toner installed therein. Various characteristic values are written in the register section 1 based on the mode data. Particularly, three kinds of the color first correction values, the color second correction values, and the color threshold values for discriminating the color are each set in advance for the red/black mode and the blue/black mode. The color image is separated into three colors, red, green, and blue for each pixel. The data indicating the brightness levels of these three colors is input to the input selecting section 2 and the brightness evaluating section 8 of this apparatus as data with 256 gradation steps.

[0039] In the input selecting section 2, referring to the mode data read from the register section 1, when it is in the red/black mode, red and green data are selected, and when it is in the blue/black mode, blue and red data are selected, and are output to the color detecting section 3. In the correction-value selecting section 10, when it is in the red/black mode, blue image data is set as a reference, and when it is in the blue/black mode, green image data is set as a reference based on the mode data from the register section 1. In the red/black mode, the red first correction value, the red second correction value, and the green threshold value are selected according to the blue data level, and in the blue/black mode, the blue first correction value, the blue second correction value, and the red threshold value are selected according to the green data level, and are provided to the color detecting section 3.

[0040] In the color detecting section 3, the input image data is subjected to a process for detecting whether it is a designated color or not based on the data of the correction value 1, the correction value 2, and the threshold value output from the register section 1. The result is output to the color determining section 4. In the brightness evaluating section 8, by setting the red, green, and blue 8-bit image data of the color image as input, the brightness level is evaluated for each pixel. The resultant values are output to the color determining section 4 and the timing control section 9. In the color determining section 4, the threshold value of the brightness is read from the register section 1, and each pixel is subjected to a process for determining color, black, or white based on the data from the color

detecting section 3 and the brightness evaluating section 8. The results are output to the matrix generating section 5.

[0041] In the matrix generating section 5, by setting the results of color determination of the color determining section 4 as input, a 5 x 5 matrix is formed for the target pixel, from which eight linear patterns are extracted. The eight patterns are output to the pattern matching section 6. In the pattern matching section 6, the eight patterns output from the matrix generating section 5 are set as input, and are each compared with a predetermined one of the two sets of reference patterns which can be selected. The result of the comparison, that is, the data on whether the patterns are matched or not, is output to the color-shift correcting section 7.

[0042] In the color-shift correcting section, it is determined whether or not to perform the color-shift correction based on the result of the pattern matching section 6. For a pattern which matches the reference pattern, the target pixel is subjected to the correcting process in accordance with the above-described method of Fig. 14. The pixel data after the correction process is externally output. For a pattern which does not match the reference patterns, the target pixel is not subjected to the correction process, and is output unchanged. In order to eliminate a delay relative to the output from the timing control section 9 and the color-shift correcting section 7, the timing relative to the input data from the brightness evaluating section 8 is controlled, and is externally output.

[0043] According to the above embodiment, a two-color separating method

is used in which, when the designated colors are red and black, the red correction value and the green threshold value are set in relation to the blue brightness level and a red area and a non-red area are discriminated, so that a flexible red-separation area can be obtained. Also when the designated colors are blue and black, the blue correction value and the red threshold value are set in relation to the level of the green brightness level, and thereby a flexible blue-separation area can be obtained in a manner similar to the above.

[0044]

[Advantages] As is evident from the above description, in the image processing apparatus of the present invention, the color image data is separated into three colors, red, green, and blue, and is converted into a two-color image with designated colors of red and black based on each brightness level. When the color image data is converted into two-color pixels, the red first correction value, the red second correction value, and the green threshold value are set, and the following expressions (1), (2), and (3) are evaluated for each pixel forming the image data.

green brightness level > green threshold value (1)

red brightness level > (green brightness level + red first correction value) (2)

red brightness level > (green brightness level + red second correction value) (3)

Discrimination of two-color separation is performed in which, for pixels in which expression (1) and expression (2) are satisfied, or expression (1) is not satisfied but expression (3) is satisfied, red is

discriminated, and for pixels other than those, non-red is discriminated. The red first correction value, the red second correction value, and the green threshold value are set with reference to the blue brightness level. Accordingly, by using the method for two-color separation in which the red correction value and the green threshold value are set in relation to the blue brightness level and the red area and the non-red area are discriminated, a flexible red-separation area can be obtained. Also when the designated colors are blue and black, a flexible blue-separation area can be obtained in a manner similar to the above.

[Brief Description of the Drawings]

Fig. 1 is a basic block diagram showing an embodiment of a color separation image processing apparatus according to the present invention;

Fig. 2 is a view showing an example of a red separation area in a red/black mode;

Fig. 3 is a view showing an example of a blue separation area in a blue/black mode;

Fig. 4 is an image view showing a visual characteristic of a color distribution of red and non-red in an RGB section;

Fig. 5 is an image view showing a visual characteristic of a color distribution of blue and non-blue in an RGB section;

Fig. 6 is an example of a construction of a 5 × 5 matrix with a target pixel as a central pixel;

Fig. 7 is an example of linear patterns which are constructed in such a way that the target pixel is set as the third pixel;

Fig. 8 is a block diagram showing an example of the overall construction of the image processing apparatus;

Fig. 9 is a view showing a procedure for determining whether the target pixel is red or not based on expression (1), expression (2), and expression (3) in a tabular form;

Fig. 10 is a view showing a procedure for determining whether the target pixel is blue or not based on expression (4), expression (5), and expression (6) in a tabular form;

Fig. 11 is a table showing the relationship between red/black separation and blue brightness level;

Fig. 12 is a table showing the relationship between blue/black separation and green brightness level;

Fig. 13 is a table showing an expression used in the evaluation for determining whether a pixel which is determined to be non-red or non-blue is white or black depending on the brightness; and

Fig. 14 is a table for explaining a procedure for correcting color shift of the target pixel.

[Description of Numerals]

1 Register section

2 Input selecting section

3 Color detecting section

4 Color determining section

5 Matrix generating section

6 Pattern matching section

7 Color-shift correcting section

8 Brightness evaluating section

9 Timing control section

10 Correction-value selecting section

9

前述図１４の方法に従い、注目画素に補正処理を行う。補正処理後の画素データは、外部に出力する。基準パターンと一致していないパターンに対しては、注目画素に補正処理を行わず、そのまま出力する。タイミング調整部９、色ずれ補正部７の出力とのディレーをなくすために、輝度計算部８からの入力データに対して、タイミングを調整して、外部に出力する。

【００４３】上記の実施形態によれば、指定色が赤、黒の場合に、赤の補正値と緑のしきい値を青の光量値と関連づけ設定し、赤と赤でない領域を識別する２色分離方法を用いることにより、より柔軟な赤分離領域を実現できる。指定色が青、黒の場合にも、青の補正値と赤のしきい値を緑の光量値と関連づけ設定し、上記と同様により柔軟な青分離領域を実現できる。

【００４４】

【発明の効果】以上の説明より明らかなように、本発明の画像処理装置は、カラーの画像データを赤、緑、青の３色に分解し、その各々の光量値に基づき画像データを赤、黒を指定色とする２色画像に変換する。この２色画素に変換する際、赤の第１の補正値と赤の第２の補正値と緑の閾値とを設定し、画像データを構成する各画素に対して下記の式（１）、式（２）、式（３）を演算する。

緑の光量＞緑の閾値　　（１）

赤の光量＞（緑の光量＋赤の第１の補正値）　　（２）

赤の光量＞（緑の光量＋赤の第２の補正値）　　（３）

式（１）および式（２）が成立し、或いは式（１）が不成立で式（３）が成立する画素に対しては赤を識別し、これ以外の画素に対しては赤でない旨の２色分離の識別を行う。赤の第１補正値と赤の第２補正値と緑の閾値は、青の光量値を参照して設定する。よって、赤の補正値と緑の閾値を青の光量値と関連づけ設定し、赤と赤でない領域を識別する２色分離方法を用いることにより、より柔軟な赤分離領域を実現できる。指定色が青、黒の場合も同様の手順で青分離領域を実現できる。

【図面の簡単な説明】

【図１】本発明の画像処理装置の色分離の実施形態を示す基本ブロック図である。

【図２】赤／黒モードの赤の分離領域例を示す図である。

【図３】青／黒モードの青の分離領域例を示す図である。

【図４】ＲＧＢ区間での赤と非赤の色分布の視覚特性を表したイメージ図である。

【図５】ＲＧＢ区間での青と非青の色分布の視覚特性を表したイメージ図である。

【図６】注目画素を中心画素とした５×５のマトリックスの構築例である。

【図７】注目画素を３番目の画素として構成したリニアパターン例である。

【図８】画像処理装置の全体構成例を示すブロック図である。

【図９】式（１）、式（２）、式（３）に基づき対象画素が赤であるか否かの判断手順を表化した図である。

【図１０】式（４）、式（５）、式（６）に基づき対象画素が青であるか否かの判断手順を表化した図である。

【図１１】赤／黒分離と青の光量値との対応関係を表した図表である。

【図１２】青／黒分離と緑の光量値との対応関係を表した図表である。

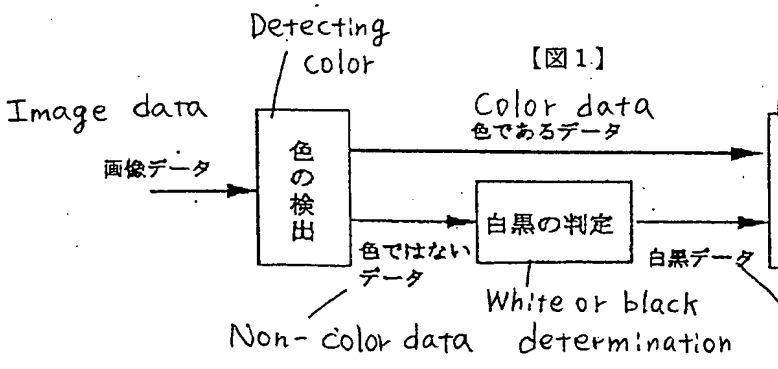
【図１３】赤または青でないと判定された画素を輝度によって白か黒かに判定する計算式を示す図表である。

【図１４】注目画素に対する色ずれ補正の手順を説明するための図表である。

【符号の説明】

１　レジスタ部
２　入力選択部
３　色検出部
４　色判定部
５　マトリックス生成部
６　パターンマッチング部
７　色ずれ補正部
８　輝度計算部
９　タイミング調整部
１０　補正値選択部

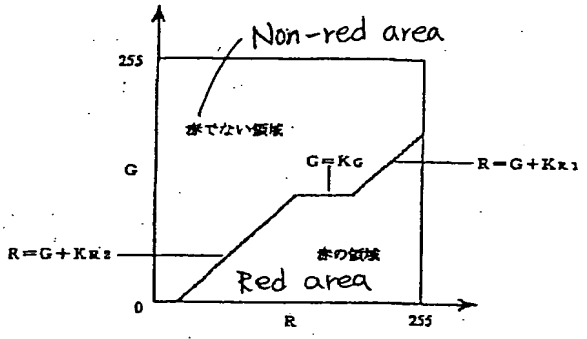
【図１】



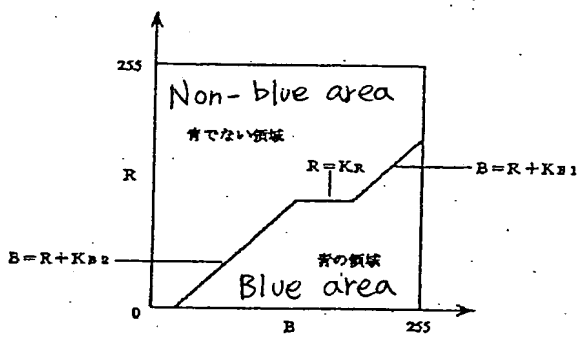
【図６】

	1	2	3	4	5
1	11	12	13	14	15
2	21	22	23	24	25
3	31	32	33	34	35
4	41	42	43	44	45
5	51	52	53	54	55

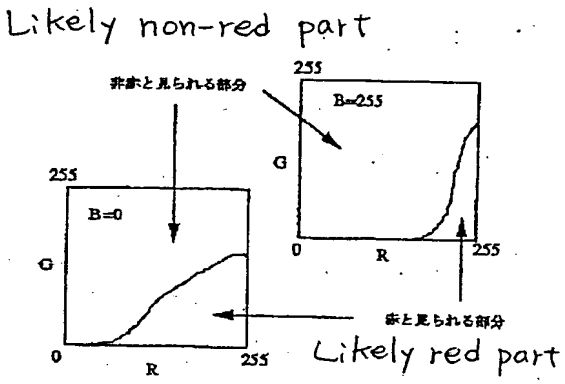
【図2】



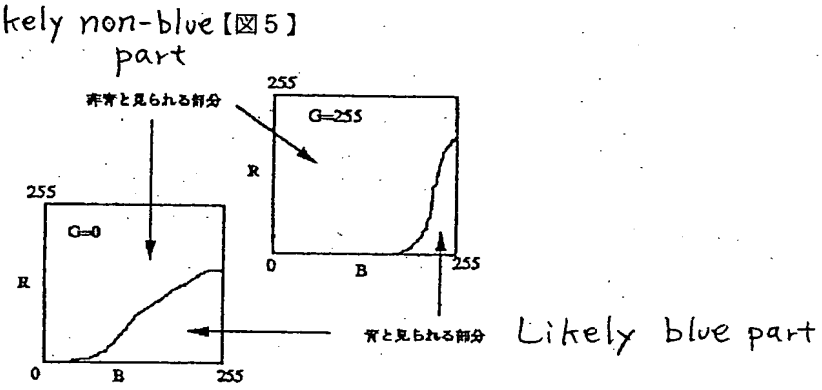
【図3】



【図4】



【図5】



【図7】

Horizontal	横	LP1	31	32	33	34	LP2	35	34	33	32
Vertical	縦	LP3	13	23	33	43	LP4	53	43	33	23
Diagonal	斜め	LP5	11	22	33	44	LP6	55	44	33	22
Diagonal	斜め	LP7	15	24	33	42	LP8	51	42	33	24

【図9】

Result of Determination

Expression

Red

式(1)	式(2)	式(3)	判断の結果	備考
1	1	無関係	赤	1：成立 0：成立せず
	0		赤でない	
0	無関係	1	赤	
		0	赤でない	

Remarks

Do hold

Do not hold

Non-red

【図10】

Result of Determination

Expression

BLUE

式(4)	式(5)	式(6)	判断の結果	備考
1	1	無関係	青	1：成立 0：成立せず
	0		青でない	
0	無関係	1	青	
		0	青でない	

Remarks

Do hold

Do not hold

Non-blue

【図11】

Correction value

Blue brightness level

青の光量値 / 補正値	B<B1	B1≦B<B2	B≧B2
KG	KG[1]	KG[2]	KG[3]
KR1	KR1[1]	KR1[2]	KR1[3]
KR2	KR2[1]	KR2[2]	KR2[3]

【図12】

Correction value

Green brightness level

緑の光量値 / 補正値	G<G1	G1≦G<G2	G≧G2
KR	KR[1]	KR[2]	KR[3]
KB1	KB1[1]	KB1[2]	KB1[3]
KB2	KB2[1]	KB2[2]	KB2[3]

【図13】

Remarks

Expression for determination

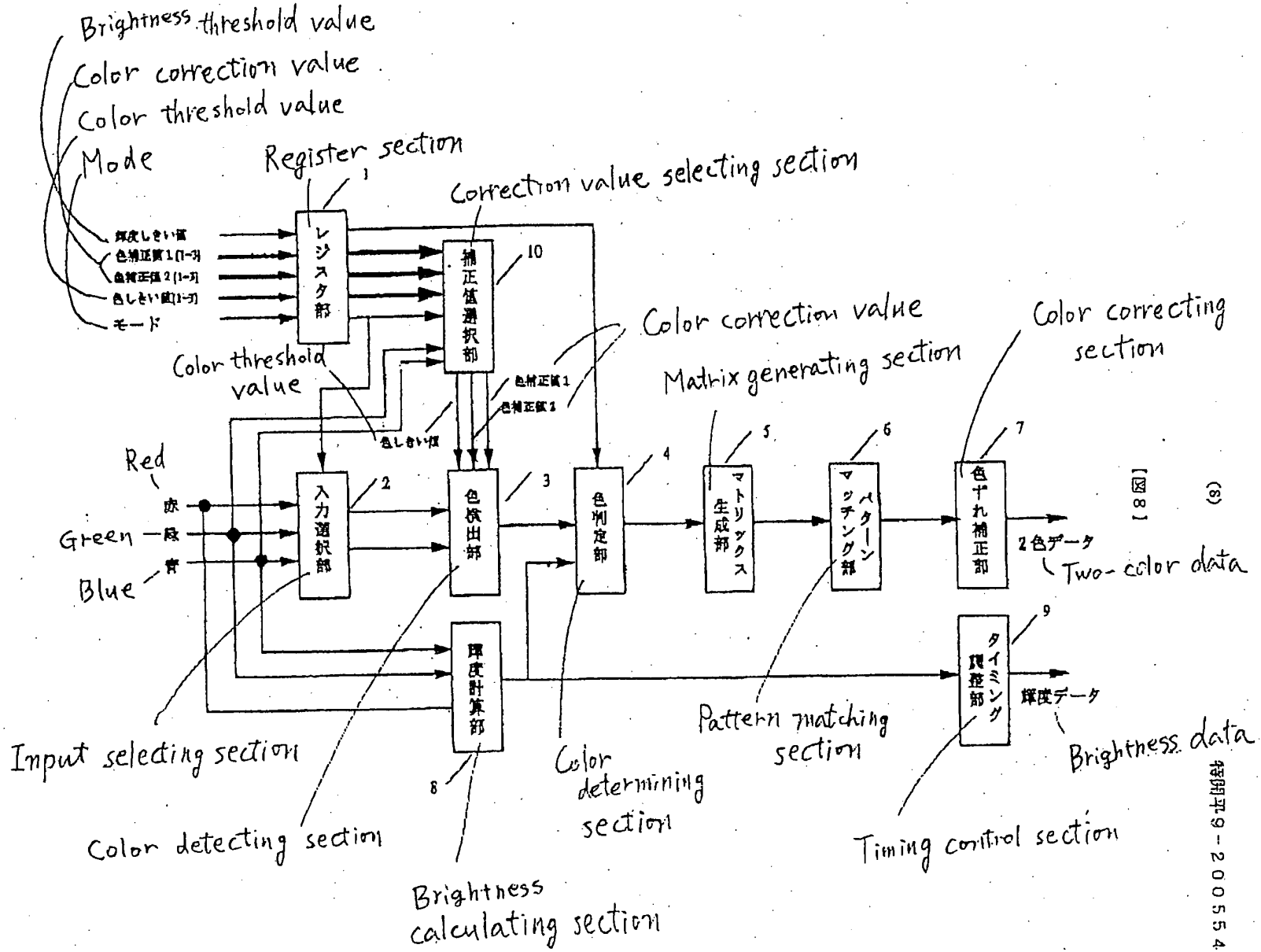
判断式	結果	備考
(2R+5G+B)／8＞Kth	白	Kth：輝度に対する白黒判定のしきい値
(2R+5G+B)／8≦Kth	黒	

Result

White

Black

Threshold value of brightness for determination



【図8】

(8)

特開平9-200554

Pattern before correction

Correcting process

Pattern after correction

【図14】

No	補正前のパターン	補正処理	補正後のパターン
1	色、色、□、白	黒→色	色、色、色、白
2	黒、黒、□、白	色→黒	黒、黒、黒、白
3	白、黒、□、白	色→黒	白、黒、黒、白
4	黒、色、□、白	色→黒	黒、色、黒、白
5	白、色、□、黒	色→黒	白、色、黒、黒
6	黒、黒、□、黒	色→黒	黒、黒、黒、黒
7	白、黒、□、黒	色→黒	白、黒、黒、黒

□の文字：注目画素

Character in □ : Target pixel

フロントページの続き

(51)Int.Cl.⁶ 識別記号 庁内整理番号 F I 技術表示箇所
H04N 1/46 H04N 1/46 Z

1	color, color, black, white	black → color	color, color, color, white
2	black, black, color, white	color → black	black, black, black, white
3	white, black, color, white	color → black	white, black, black, white
4	black, color, color, white	color → black	black, color, black, white
5	white, color, color, black	color → black	white, color, black, black
6	black, black, color, black	color → black	black, black, black, black
7	white, black, color, black	color → black	white, black, black, black